

## CLAIMS

1. Method for diagnosing a critical state of charge condition of an energy storage system, comprising:

obtaining power flow and state of charge for the energy storage system;

5 determining if the combination of power flow and state of charge meet predetermined criteria;

if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration.

2. Method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 1 wherein the predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge.

3. Method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 1 wherein the predetermined criteria are characterized by increasingly less tolerance for discharge power flow at increasingly lower state of charge.

4. The method for monitoring an energy storage system state of charge as claimed in claim 1 wherein the predetermined duration is a function of the state of charge that generally decreases as the state of charge trends away from the predetermined region of state of charge and generally increases  
5 as the state of charge trends toward the predetermined region of state of charge.

5. Method for diagnosing a critical state of charge condition of an energy storage system, comprising:

- establishing charge and discharge thresholds for the energy storage system as a function of state of charge within predetermined regions of
  - 5 extreme high and low state of charge, respectively;
  - obtaining energy storage system power and state of charge;
  - comparing the energy storage system power to the appropriate one of the charge and discharge thresholds after the state of charge enters one of the predetermined regions of high and low state of charge from an
  - 10 intermediate region of state of charge;
  - if the energy storage system power violates the appropriate one of the charge and discharge thresholds while the state of charge is within the one of the predetermined regions of high and low state of charge, monitoring the duration that the state of charge remains within the one of the predetermined
  - 15 regions of high and low state of charge; and,
  - if the duration exceeds a predetermined duration, providing an indication of a critical state of charge condition.

- 6. The method for monitoring an energy storage system state of charge as claimed in claim 5 wherein the predetermined duration is a function of the state of charge that generally decreases as the state of charge moves away from the intermediate region of state of charge and generally increases
- 5 as the state of charge moves toward the intermediate region of state of charge.

- 7. Method for diagnosing a critical state of charge condition of an energy storage system, comprising:
  - within a predefined extreme range of state of charge, providing a plurality of state of charge thresholds and a corresponding plurality of unique
  - 5 increment values, said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge;
  - periodically obtaining state of charge;
  - for so long as state of charge is outside of the predefined range of
  - 10 non-extreme state of charge

comparing the state of charge to the state of charge thresholds  
and selecting one of said increments in accord with the  
comparison;

15

incrementing a counter with the selected increment;  
comparing the counter to a counter limit; and  
providing an indication of a critical state of charge condition if  
said counter exceeds said counter limit.

8. The method for diagnosing a critical state of charge condition of  
an energy storage system as claimed in claim 7 wherein the predefined  
extreme range of state of charge corresponds to high state of charge.

9. The method for diagnosing a critical state of charge condition of  
an energy storage system as claimed in claim 7 wherein the predefined  
extreme range of state of charge corresponds to low state of charge.